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Introduction: Primary enuresis is the most common elimination disorder in children and adolescents aged 5-17 years worldwide. It often results in psychological, social, and financial problems. This disorder is understudied in less affluent countries.

Objective: This study was done to assess the prevalence and associated factors of primary enuresis in children and adolescents in Bahir-Dar Town, Ethiopia.

Materials and Methods: This cross-sectional community-based study was conducted in children and adolescents from May to July 2016. A total of 1547 subjects were selected using a multistage sampling technique. Data were collected using DSM-5 criteria and the Strengths and Difficulties Questionnaire (SDQ).

Results: A total of 1520 participants were involved in the study with a response rate of 98.25%. The prevalence of primary enuresis was 8.6%. Age range 5-8 years [AOR=10.35, 95% CI (3.468, 30.875)], deep sleep [AOR=2.18, 95% CI (1.192, 3.983)], and conduct problems [AOR=5.98, 95% CI (3.341, 10.694)] were significantly associated with primary enuresis.

Conclusions: Factors that affect primary enuresis are young age, deep sleep, snoring during sleep, sleeping more than two hours a day, and conduct problems. Therefore, special attention should be given to children and adolescents about primary enuresis prevention.

Keywords: Primary enuresis; Child; Adolescent.

Running Title: Associated Factors of Primary Enuresis

Introduction

Enuresis can be defined as an involuntary or intentional voiding of urine beyond the age of 5 years in the absence of the physiological effect of a substance or general medical condition (1). Primary enuresis consists of lack of established urinary continence for more than six months (2). Enuresis is one of the most complicated and common children's and adolescents' problems worldwide (3, 4), and an old but still prevalent clinical problem (5).

It affects 5 to 7 million children in the United States (6) and one-fifth of children and adolescents in Addis Ababa, Ethiopia (7).

The etiology of primary enuresis is not yet clear (8,9). Most studies have shown that the risk factors of PE are male gender, young age, family history of enuresis, divorced parents, deep sleep, and growth and development (1, 6, 9, 10, 11, 12, 13, 14).

The frequency of bedwetting shows the severity of primary enuresis (6). Persistent bedwetting may compromise the relationship between parents and children (6, 10) and leads to distressed, poor self-esteem, psychological problems, and poor school success (10, 11, 12).

The prevalence of primary enuresis varies due to different diagnostic criteria, age, and sex, with a range of 3.1% to 37% (1, 2, 5, 6, 13, 15-21). The overall 12-month prevalence of primary enuresis in United States is 4.45% (18).

The total magnitude of primary enuresis in Turkey is 1.1 to 17.5 in different sample sizes and age groups using different questionnaires (2, 15, 22). The prevalence of PE is 3.1% in Hong Kong (5), 8% in Taipei, Taiwan (20), 8.7% in Rafsanjan, Iran (10, 23), and 17.5% in other studies in Iran (11, 24).

In Africa, different studies have shown different results for the prevalence of primary enuresis. Its prevalence is 37.0% in Nigeria (25), 10.53% in Benha, Egypt (12), 11.5% in Menofia governorate of Egypt (1), 3.44% in Khartoum, Sudan (4) and 20.8% in Addis Ababa, Ethiopia (7).

Factors associated with primary enuresis are male gender, young age, and attention deficit hyperactivity disorder in U.S. (18); young age, low income, and family history in the southeast of Turkey (17); family history and parents' low education level in Istanbul, Turkey (16); male gender, young age, family history, parents' low educational level, deep sleep, large number of siblings, and other people sleeping in the child's room in Ankara, Turkey (2); and male gender, deep sleep, divorced or separated parents, and family history in Taipei City, Taiwan (20). In Rafsanjan, Iran, it has been shown that parents' education, low family income, and young age are factors associated with primary enuresis (24). Another study in Gonabad, Iran showed male age, growth failure, and young age were the associated factors (23). In Nigeria, behavioral disorders, sleeping habits, and low family income have been reported to be associated with enuresis (25). A study in Benha, Egypt showed that young age, low family income, low education level, family history, and emotional and psychological behaviors are factors associated with enuresis (12). Another study in Egypt showed that the associated factors were birth order, family history, low parents' education level, poor socio-economic status, heavy sleep, snoring, and lack of a comfortable sleep (1). A study in Khartoum, Sudan showed that family history of enuresis and stressors were associated with PE (4). In a study done in Addis Ababa,

Ethiopia, factors associated with enuresis were male gender, young age, extreme poverty or financial problems, parental separation, anxiety disorders, and disruptive behavioral disorders (7). Primary enuresis is a common childhood problem and its prevalence varies according to age, with the highest prevalence in the school-aged children. It can result in many psychological consequences such as low self-esteem and shame, and affects interaction with friends and families. This problem can be stressful for parents and other family members. Therefore, this study was intended to determine the magnitude and associated factors of primary enuresis in children and adolescents in Bahir Dar, north-western Ethiopia.

Materials and Methods

Study design and setting

This community-based cross-sectional study was conducted from May to July 2016 in Bahir-Dar. Bahir-Dar To, which is the town of Amhara National Regional State, is located 565 Km northwest of Addis Ababa, Ethiopia. Administratively, Bahir-Dar has nine kifle-ketema or 32 urban kebeles. According to 2007 G.C census and population projection of Ethiopia for all regions at Wereda level from 2014 – 2017 G.C (26), the number of households is 46,325 and the estimated number of urban population of Bahir Dar is 297,794, of whom 108,831 children and adolescents are 5 to 19 years old. Out of 108,831 children and adolescents, 59,277 are females and 49,554 are males. Psychiatric services are found at public referral hospitals and one private hospital. The target population was all children and adolescents who lived in Bahir-Dar and the study population was children and adolescents who lived in Bahir-Dar during the study period.

The sample size required for this study was 1547 determined using single population proportion formulas by considering a prevalence of 20.8% for enuresis in children and adolescents (7), a confidence interval of 95%, and an error margin of 3%. Design effects were used and multiplied by 2 and 10% was added for the non-response rate.

Multi-stage sampling was applied. In stage one, from 32 urban kebeles, seven were selected randomly using the lottery method. Then, systematic random sampling was used to select the households. The lottery method was used to select only one participant when there was more than one child or adolescent in the household.

Data were collected on primary enuresis by using following criteria:

A: A child or adolescent has bed, cloth or all wetting.

B: The problem occurs twice a week.

C: The disorder happens for at least three consecutive months.

D: A child or adolescent has never developed urinary continence for a period of more than six months.

So, if a child or adolescent has scores "4" primary enuresis and for less than "4" no primary enuresis are considered (27). Socio-demographic characteristics, emotional and behavioral problems, growth and development delay, and bedtime habits were considered as related factors. Primary enuresis was diagnosed through interview using a standardized semi-structured questionnaire developed from the DSM -5 (27). The questionnaire had three screening and four diagnosing items.

The sleep habit was recorded through interview using a semi-structured questionnaire developed from the two studies entitled "prevalence and Associated Factors of Enuresis in Turkish Children" and "Nocturnal Enuresis Among School Children in Menofia Governorate, Egypt; a Hidden Problem" (1, 2).

The children's and adolescents' emotional symptoms, conduct problems, and hyperactivity problems were measured using the Strengths and Difficulties Questionnaire (SDQ). Each problem and symptom has five items, comprising a total of 15 items. Each item scores 0, 1, or 2. "Not true" scores 0, "somewhat true" scores 1, and "certainly true" scores 2. The total SDQ score for each problem and symptom is the sum of individual item scores, ranging from 0 to 10. Items are all coded so that for conduct problems scale 0-3, 4 and 5-10, and for hyperactive problem and emotional symptoms scale 0-5, 6 and 7-10, they correspond to no problems (low need), some problems (some need) and severe problems (high need) respectively (28, 29). Growth and developmental delay was assessed using a semi-structured questionnaire. It has 6 items at least one yes, one is a cut of point to be developmental disorder (30). A semi-structured questionnaire was used to collect socio demographic data.

Data processing and analysis

Data were first checked for completeness and consistency. The data were then coded and entered into the EPI info version 3.5.3, and finally exported to and analyzed by SPSS version 20.

Descriptive statistics were used to estimate the prevalence of primary enuresis and describe the variables. Bivariate and multivariable logistic regression analysis were conducted to identify factors associated with primary enuresis. The strength of association is presented by odds ratio and 95% CI. Independent variables $p \leq 0.2$ in bivariate logistic regression analysis were entered to multivariable logistic regression analysis by the enter method. Variables with $p < 0.05$ in multivariable logistic regression analysis were considered to have a significant association with dependent variables. For children aged 5 to 11 years, the parents or caregivers were interviewed while adolescents aged 12 to 17 years were interviewed directly. Ethical clearance was obtained from the Institutional Review Board (IRB) of College of Medicine and Health Science, University of Gondar and from Amanuel Mental Specialized Hospital. Permission was obtained from Bahir-Dar Special Zone and kebeles administrative offices. The aim of the study was explained to the study participants and data were collected after written consent was obtained from parents /guardians/ caregivers and verbal consent was obtained from children. The participants had the right to withdraw at any time during the study and ask their questions about the study. The participants were also assured of data confidentiality and anonymity.

Results

Of 1547 subjects, 1520 participated in the study (response rate =98.25%).

Socio-demographic characteristics of study participants

Of 1520 participants, 797 (52.4%) were boys. The mean age of the participants was 9.25 ± 1.613 years.

Of all respondents, 794 (52.2%) were 5-8 years old, 1130 (74.3%) were one the first three children, 1247 (82.2%) were primary school students, 1401 (92.2%) lived with their families, and 1280 (84.2%) were their family married. The father's education level was elementary grades in 932 (61.3%) and the mother's education level was elementary grades in 913 (60.1%) children (Table 1).

Sleeping habit, growth and developmental delay Among the study participants, 178 (11.7%) had a deep sleep and 139 (9.1%) could sit unaided after six months (Table 2).

Table 1. Distribution of socio-demographic characteristics in children and adolescents in Bahir-Dar, 2016 G.C. (n=1520)

Variables		Frequency (%)
Sex	Female	797(52.4)
	Male	723(47.6)
Age	5-8	794(52.2)
	9-12	441(29.0)
	13-17	285(18.8)
Birth order	1-3	1130(74.3)
	>=4	390(25.7)
Educational level	Primary school or less	1247(82.0)
	Secondary school	273(18.0)
With whom the participant lives	with family	1401(92.2)
	With relatives	119(7.8)
Marital status of the participant's family	Married	1280(84.2%)
	Single	70(4.6%)
	Separated/Divorced	101(6.6%)
	Widowed	69(4.5%)
Father's education level	Primary school or less	932(61.3)
	Secondary school	427(28.1)
	More the secondary school	161(10.6)
Mother's education level	Primary school or less	913(60.1)
	Secondary school	491(32.3)
	More the secondary school	116(7.6)

Emotional and behavioral problems:

From all participants, 70 (4.6%) had severe conduct problem (Table 3).

Prevalence of primary enuresis among Participants

Among the participants, 130 (8.6%) had primary enuresis.

The distribution of primary enuresis was related to socio-demographic characteristics.

One hundred and thirty subjects (8.6%) fulfilled the criteria of primary enuresis, of whom more than half (n=72, 55.4%) were male, 106 (81.5%) were 5 to 8 years, 73 (56.2%) were birth order 1 to 3, 124 (95.4%) were in elementary grades, and 112 (86.2%) lived with parents. A total of 90 (69.2%) children's families were married (Table 4).

Table 2. Frequency and percentage of sleeping habit, growth and developmental delay in study subjects in Bahir-Dar, 2016 G.C. (n=1520)

Variables		Frequency (%)
Deep sleep	No	1342(88.3)
	Yes	178(11.8)
Sharing bedroom with other people	No	1437(94.5)
	One or more person	83(5.4)
Snoring during sleep	No	1433(94.3)
	Yes	87(5.7)
Sleeping more than two hours a day	No	1423(93.6)
	Yes	97(6.4)
First smile after 2 months	No	1389(91.4)
	Yes	131(8.6)
Sitting up unaided after 6 months	No	1381(90.9)
	Yes	139(9.1)
Walking alone after 18 months	No	1395(91.8)
	Yes	125(8.2)
Imitating 1-2 words after 18 months	No	1396(91.8)
	Yes	124(8.2)
Naming one body parts after three years	No	1397(91.9)
	Yes	123(8.1)

Table 2. Frequency and percentage of emotional and behavioral problems of participants in Bahir-Dar, 2016 G.C. (n=1520)

Variables		Frequency (%)
Conduct problems	No problem	1350(88.8)
	Some problem	100(6.6)
	Sever problem	70(4.6)
Hyperactivity problems	No problem	1515(99.7)
	Some problem	3(0.2)
	Sever problem	2(0.1)
Emotional symptoms	No problem	1495(98.4)
	Some problem	11(0.7)
	Sever problem	14(0.9)

Associated factors of primary enuresis in study subjects at Bahir -Dar, north-west of Ethiopia
Multiple logistic regressions were used to minimize the risk of confounders. Age, birth order,

Table 3. Distribution of primary enuresis according to socio-demographic characteristics in children and adolescents in Bahir-Dar, 2016 G.C. (n=130)

Variables		Primary enuresis frequency (%)
Sex	Female	58(44.6)
	Male	72(55.4)
Age	5-8	106(81.5)
	9-12	19(14.6)
	13-17	5(3.8)
Birth order	1-3	73(56.2)
	> =4	57(43.8)
Educational level	Primary school or less	124(95.4)
	Secondary school	6(4.6)
With whom participant lives	With family	112(86.2)
	With relative	18(13.8)
Marital status of subject's parents	Married	90(69.2)
	Single	7(5.4)
	Separate	15(11.5)
	Widowed	18(13.8)
Father's education level	Primary school or less	63(48.5)
	Secondary school	48(36.9)
	More than secondary school	19(14.6)
Mother's education level	Primary school or less	82(63.1)
	Secondary school	35(26.9)
	More than secondary school	13(10.0)

deep sleep, other people sleeping in child's bedroom, sleeping more than two hours a day, and conduct problems had a significant association with PE.

Factors associated with primary enuresis were age between 5-8 years [AOR=10.35, 95% CI 3.468-30.875], deep sleep [AOR=2.18, 95% CI 1.192-3.983], and conduct problems [AOR=5.978, 95% CI 3.341-10.694] (Table 5).

Table 4. Distribution of primary enuresis with related factors in children and adolescents in Bahir-Dar, 2016 G.C.(n=130)

Variables		Primary enuresis frequency (%)
Time of incontinent	Diurnal	2(1.5)
	Nocturnal	96(73.8)
	Both	32(24.6)
Deep sleep		45(41.5)
Sharing bedroom with other people	No	102(78.5)
	One or more person	28(21.5)
Snoring during sleep		35(26.9)
Sleeping more than two hours a day		53(40.)
First smile after two months		52(40.0)
Sitting up unaided after 6 months		54(41.5)
Walking alone after 18 months		54(41.5)
Imitating 1-2 words after 18 months		52(40.0)
Naming one body parts after three years		51(39.2)
Conduct problems	No problem	76(58.5)
	Some problem	25(19.2)
	Sever problem	29(22.3)
Hyperactivity problems	No problem	125(96.2)
	Some problem	3(2.3)
	Sever problem	2(1.5)
Emotional symptoms	No problem	110(84.6)
	Some problem	7(5.4)
	Sever problem	13(10.0)

Discussion

Prevalence of primary enuresis

This study showed that the prevalence of primary enuresis was 8.6% in children and adolescents (95% CI=7.2, 9.9). This finding was in line with reports from Taiwan 8% (20) and Iran 9.67% (16). Our finding was higher than some other studies conducted in the United States (4.45%) (18), Hong Kong (3.1%) (5), and Sudan (3.44%) (4). The variation might be due to the differences in the measurement tool and sample size; for instance, the studies conducted in the United State and Hong Kong used the Diagnostic Interview Schedule for Children and a self-administered questionnaire, respectively. In Sudan, the researchers used 816 samples. On the contrary, the result of the present study was lower than the

Table 5. Factors associated with PE among in study participants in Bahir-Dar, North-west of Ethiopia, 2016 G.C.

Variables		Primary enuresis		COR (95%)	AOR (95%)
		Yes	No		
Sex	Female	58	739	1	1
	Male	72	651	1.41(0.982, 2.023)	1.59(0.954, 2.651)
Age	5-8	106	688	8.628(3.481,21.384)	10.35(3.468,30.875) **
	9-12	19	422	2.521(0.931, 6.831)	1.55(0.456, 5.262)
	13-17	5	280	1	1
Birth order	1-3	73	1057	1	1
	>=4	57	333	2.48(1.716, 3.580)	3.50(2.034, 6.021) **
Educational level	Secondary & more	6	269	1	1
	Primary & less	124	1123	4.914(2.142,11.269)	5.20(1.722,15.708)**
With whom the participant lives:-	With family	112	1289	1	1
	Relative	18	101	2.05(1.198, 3.510)	1.65(0.717, 3.785)
Father's education level	Primary	63	869	0.542(0.315,.932)	0.25(0.100, 0.643)**
	Secondary	48	379	0.947(0.538, 1.66)	0.55(0.233, 1.271)
	More than secondary	19	142	1	1
Mother's education level	Primary	82	831	0.79(0.421, 1.453)	1.79(0.601, 5.295)
	Secondary	35	456	0.61(0.311, 1.190)	0.89(0.320,2.492)
	More than secondary	13	103	1	1
Deep sleep	No	76	1266	1	1
	Yes	54	124	7.25(4.889, 10.764)	2.18(1.192, 3.983) **
Sharing bedroom with others	No	102	1335	1	1
	One or more	18	55	6.663(4.051, 10.959)	6.95(3.352,14.388)**
Snoring during sleeping	No	95	1338	1	1
	Yes	35	52	9.480(5.887, 15.265)	2.05(0.929, 4.528)
Sleeping more than two hours a day	No	77	1346	1	1
	Yes	53	44	21.05(13.28, 33.388)	12.90(6.361,26.148) **
First smile after two months	No	78	1311	1	1
	Yes	52	79	11.06(7.284, 16.803)	0.53(0.110, 2.544)
Sitting up unaided after 6 months	No	76	1305	1	1
	Yes	54	85	10.91(7.224, 16.472)	0.63(0.89, 4.437)
Imitating 1-2 words after 18 months	No	78	1318	1	1
	Yes	52	72	12.20(7.990, 18.640)	1.82(0.250, 13.177)
Naming one body parts after three years	No	79	1318	1	1
	Yes	51	72	11.82(7.730, 18.067)	1.47(0.180,11.996)
Conduct problems	No problem	76	1274	1	1
	Some & Sever problem	54	116	7.80(5.245,11.610)	5.98(3.352,14.388) **

prevalence reported in Nigeria (37.0%) (24), Egypt (11.5%), and Addis Ababa, Ethiopia (20.8%) (7). This discrepancy might be due to differences in the questionnaire and study population. For instance, there were population differences in Nigeria and Egypt and a structured questionnaire was used while in Addis Ababa, the instrument that was used to assess enuresis was the DICA and the participants were below nine years.

Factors associated with primary enuresis

The odds of primary enuresis in the age group 5-8 years were 10.35 times [AOR=10.35, 95% CI 3.468-30.875] higher than the odds of the age group 13-17 years. The possible reason might be developmental immaturity of voiding control. This finding is consistent with the findings reported in U.S, (18), Turkey (15), Iran (16), Egypt (12), and Addis Ababa, Ethiopia (7).

The odds of primary enuresis among children and adolescents whose birth order was greater than or equal to four were 3.50 times [AOR=3.50, 95% CI 2.034-6.021] higher than the odds of enuresis in birth order 1-3. The possible reason might be due a feeling of neglect. This finding is congruent with a study in Egypt (1).

The odds of primary enuresis in deep sleepers were about two times [AOR=2.18, 95% CI 1.192-3.983] higher than the odds in non-deep sleepers. A possible reason might be inability to be aroused by a sensation of a full bladder. This finding is in line with the results of the studies conducted in Turkey (22), Nigeria (25), and Egypt (1).

The odds of primary enuresis in subjects who slept more than two hours a day were 12.90 times [AOR=12.90, 95% CI 6.361-26.148] higher than its odds in the subjects who did not sleep during the day. A possible reason might be frequent awakening during the night. The finding is similar to the results of a study in Nigeria (25).

The odds of primary enuresis were 5.98 times [AOR=5.98, 95% CI 3.341-10.694] higher in children and adolescents who had conduct problems than those without conduct problems. A possible reason might be they thought it as a normal circumstance. This result is congruent with the results of studies in Nigeria (25), Egypt (12), and Addis Ababa, Ethiopia (7).

The odds of primary enuresis among children and adolescents who had primary education or less were 5.20 times [AOR=5.20, 95%CI (1.722, 15.708)] higher than the odds in those with secondary education or higher. A possible reason might be low self-esteem, shame, and poor relationship with classmates. This finding is consistent with results of a study conducted in Egypt (12).

The odds of primary enuresis in children and adolescents whose father had primary education or less were 75% [AOR=0.25, 95% CI (0.100, 0.643)] lower than it odds in subjects whose father had secondary level education or more. A possible reason might be that mothers take care of children. The finding was different from the results of studies in Egypt (12), Turkey (15, 22), and Iran (16).

The odds of primary enuresis in children and adolescents whose bedroom was used with one or more people were 6.95 times [AOR=6.95, 95% CI (3.352, 14.388)] higher than the odds of sleeping with family. A possible reason might be stress or discomfort. This finding was in line with a study in Turkey (22).

Conclusions

The prevalence of primary enuresis was average compared to other studies. It was significantly associated with young age, not being the first child, deep sleep, snoring during sleep, sleeping more than two hours a day, low education level, father's primary education level or less, sharing the bedroom with other people or siblings, and conduct problems.

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Authors' contributions

BG designed the study, participated in the data collection, performed analysis and interpretation of data and prepared the manuscript. **BW, FZ** and **TA** assisted in the design and participated in data analysis and revised subsequent drafts of manuscript. All authors approved the final manuscript.

Disclosure

The authors declare that they have no competing interests

Conflict of Interest

None declared

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